What determines macroeconomic volatility? A cross-section and panel data study

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Abstract – This paper examines the determinants of the volatility in growth rates, seeking to expand on a very limited literature that has focused almost exclusively on financial determinants of volatility. An analysis of 41 variables and their effects on growth volatility yields some surprising results: the relationship between financial sophistication and volatility is not clearly negative as expounded in many studies, the oft cited negative relationship between real GDP per capita and volatility turns out to be positive, and there is no stable significant relationship between inflation and volatility. The main policy implication for authorities is that intervention in most cases, whether in the form of trade and currency controls, or high government consumption, tends to exacerbate volatility.

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1. Introduction

The macroeconomic literature is rife with econometric studies on the determinants of the growth rates of economies Barro, R. and X. Sala-i-Martin (1995) Ramey, G. and V. E. Ramey (1995) Kalaitzidakis, P., T. P. Mamuneas and T. Stengos (2002) Temple, J. (2002) Kroft, K. and H. Lloyd-Ellis (2002) Levine, R., N. Loayza and T. Beck (2000, Levine, R. and D. Renelt (1992) to name a few, and of the effect of volatility of growth rates on the level of growth rates Imbs, J. (2002) Dawson, J. W. and E. F. Stephenson (1997), Macri, J. and D. Sinha (2000), yet seemingly ignores the issue of what determines the volatility of growth rates in economies. Exceptions to this are papers by Easterly, W., R. Islam and J. E. Stiglitz (2000), Denizer, C. A., M. F. Iyigun and A. Owen (2002), Bekaert, G., C. Harvey and C. Lundblad (2004), Cavallo, E. (2005), Cecchetti, S., A. Flores-Lagunes and S. Krause (2006), Kent, C., K. Smith and J. Holloway (2005), Mobarak, A. (2004) who directly address the issue of the determinants of growth variability mostly in terms of financial variables, but not general macroeconomic variables. Amongst other things, one of the goals of this paper is to address this shortcoming by adding many more macroeconomic variables to the analysis.

But why study the volatility in the growth rate and not the volatility in GDP per capita? The average or trend growth rate of an economy will tend to be determined by structural parameters which change very slowly over time, such as the composition of economic activity in various sectors of the economy. For example, a large dependence on agriculture may lead to lower growth rates than an economy heavily invested in high-tech industries. When planning their budgets, consumers will incorporate some estimate of the future growth rates of income in their calculations, anticipating the fact that the level of their future income has a time trend component. By examining the volatility of GDP per capita one would interpret such a trend as implying volatility and therefore uncertainty. This however would not be correct because the economic agents anticipate this type of volatility in GDP per capita as it is due to the trend growth rate and therefore does not represent true uncertainty to them. Hence, it is clear that a better definition of uncertainty is the one that uses volatility of the growth rate rather than that of GDP per capita levels.

There are numerous reasons as to why research into the determinants of volatility is important. Firstly, volatility in growth rates affects the volatility of incomes and therefore also represents a measure of the uncertainty that economic

agents face about the future. Uncertainty in turn can have many real effects on the economy, such as affecting the future level of the growth rate in the economy, the level of investment etc. Secondly, government policy is often directed towards reducing the volatility of the economy's time path i.e. smoothing out the fluctuations in the time path of GDP per capita and therefore such an analysis would have considerable policy implications. Thirdly, assuming that agents in the economy are not risk neutral, volatility in growth rates produces welfare effects and therefore is an important determinant of real welfare in an economy, see Spiliopoulos, L. (2004).

Apart from a lack of econometric studies into the determinants of volatility, there are also very few theoretical papers which can be used as guidance as to what variables to examine in the econometric studies.

Aghion, P., A. Banerjee and T. Piketty (2000)) show that if there exists a high degree of physical separation between investors and savers, and there exist capital market imperfections in the sense that borrowers are constrained as to how much they can borrow from savers, then the economy may cycle around its long run steady state growth rate. Hence, according to this theory proxies of financial market sophistication should be included as determinants of volatility and the relationship between financial sophistication and volatility is negative. Acemoglu, D. and F. Zilibotti (1997)) in their model show that in the early states of development of an economy with capital scarcity and investment project indivisibilities, economic agents will not be able to diversify away risk effectively as they can only invest in a limited number of imperfectly correlated investment projects. Hence, poorer countries in the early stages of development will tend to have higher volatility, leading to a negative relationship between the real GDP per capita level and volatility.

These two models posit a negative relationship between volatility and financial sophistication; however this is not necessarily the case as an opposite argument can be put forth. The more sophisticated and larger the financial market of an economy the greater the amount of credit that can be channeled through the financial system. Credit creation by private financial institutions will be higher and as a result the level of credit in the economy will be more difficult for the authorities to control. This would also lead to greater leverage in the economy which could translate into greater volatility for a number of reasons. Firstly, if more credit is available then more projects can be undertaken reducing the average quality of investments in the economy i.e. the last investments undertaken will suffer from lower expected average

return and greater risk (volatility). Secondly, a more sophisticated financial sector may lead to an increase in investment as a share of GDP in the economy, and given that investment is extremely volatile (more so compared to the other constituents of national income, such as consumption) the economy as a whole will be more volatile as a result of this shift. Hence, the argument that financial market sophistication leads to less volatility should not be taken as conclusive.

The signs of the effects of export and import share of GDP on volatility will depend on whether a particular country's economic cycle is in sync with that of the countries it trades with. If it is then it will exacerbate the country's economic cycle but if there is a negative correlation then it is possible for a large export market to provide a stabilizing and smoothing effect. In general however it is more likely that countries' economic cycles are positively correlated since shocks to economies tend to be correlated and therefore we expect increased openness to add to volatility. The magnitude of the sign for a particular country however would depend on how volatile the economies of one's trading partners are.

Standard economic theory on the economic costs of inflation would conclude that there should be a positive relationship between the level of inflation and volatility in the economy, as high levels of inflation lead to economic uncertainty.

2. Methodology

The model specification method used in this paper will be of paramount importance as there does not exist much theory for guidance; the results hopefully may prompt theory to explain them. Much of the discussion as regards appropriate methods of specification will track the growth equation literature as essentially this literature faces the same problem.

It is very common for different studies to use different conditioning sets depending on what variables they are focusing on, thereby sometimes reaching different conclusions as to the significance and even the sign of estimated coefficients. This is especially true of the empirical growth literature where many results appear to be non-robust or fragile. Levine, R. and D. Renelt (1992)) addressed this issue by using a variant of Leamer's Extreme Bounds Analysis (EBA) to investigate the robustness of the relationships between independent variables and the growth rate. In their study they chose 3 significant variables which were present in all equations, one variable which was being examined, and combinations of up to 3 other

variables from the remaining set. These regressions were run with all possible combinations of up to 3 variables leading to a set of estimated coefficients for the variable under investigation. The upper extreme bound of a coefficient is defined as the highest value of the estimated coefficient plus two standard deviations; the lower extreme bound is the lowest estimated coefficient minus two standard deviations. A variable's relationship with the growth rate is considered robust if at the extreme bounds the coefficient remains significant and of the same sign.

This test however seems to be overly strict in its definition of robustness and indeed, Levine and Renelt find that very few of the independent variables pass this test. One of the main problems with the EBA is that collinearity problems can affect both the values of estimated coefficients and their significance. Hence, when one is estimating many models it is very likely that due to collinearity, even if the variable is a true predictor it may be insignificant or of opposite sign at the extreme bounds.

In response to these criticisms, Sala-i-Martin, X. (1997) proposes to look at the whole distribution of coefficient estimates instead of only at the extreme bounds, thereby utilizing more information from the regressions. He defines a variable as robust if at least 95% of the cumulative distribution function of the coefficient lies to one side of zero. Hence, this test allows for some estimates of the coefficient to be either insignificant or of opposite sign compared to the majority of estimates – also, estimated coefficients were weighted in proportion to the fit of the equation so as to give less weight to badly fitting equations which are likely misspecified. Using this looser criterion, Sala-i-Martin concludes that more variables are robust than Levine and Renelt found, specifically he finds 21 significant variables (not including the three fixed variables in all equations) out of 59. This approach also allows for a spectrum of robustness and significance, instead of the strict labeling of robust or non-robust by EBA.

Sala-i-Martin used 3 fixed variables in all equations, one variable under consideration and only allowed 3 other variables to vary. The three variables were fixed primarily to reduce the computational cost of this procedure as the number of combinations of all variables can quickly become immense. These 3 variables were chosen on the basis of their consistent inclusion and significance in growth equations from many different studies.

Unfortunately, in modeling the volatility of the growth rate we are not afforded the luxury of having numerous empirical and theoretical studies on which to

base a decision of which variables to fix. Hence, all variables will be variable in all combinations of regressions run and hence no variables will be fixed.

The datasets used were from Sala-i-Martin, X. (1997), King, R. G. and R. Levine (1993), Global Development Finance (2003) and the Penn World Table Ver. 6.1 Heston, A., R. Summers and B. Aten (2002). Independent variables were chosen out of the variables used in the growth literature as there is reason to believe that the same variables may be affecting volatility, albeit in different ways and for different reasons. A total of 41 independent variables were included in this study, after discarding other variables which have no a priori reason to influence volatility directly, such as education and human capital variables. Some available variables were dropped from this analysis on the basis of redundancy as other similar measures existed, in particular if bivariate correlations between possible alternative variables were greater than 0.7. A special case is that of export and import share which have a correlation coefficient of 0.8. Also the sum of these, trade share, is correlated with each individual variable by more than 0.9. This has prompted criticism of econometric studies linking export share to other variables as essentially examining trade share and not export share. A simple solution to this is to include trade share as a variable and exclude import and export share. However, since it would be more interesting to break down the effects of export and import share rather than lump them together this study uses both trade share and trade balance share (export minus import share). The correlation between these two variables is only -0.16, eliminating the problem of collinearity. Using the two estimates on these variables we can then reconstruct individual coefficient estimates for export and import share. Let a and b be the coefficients for trade share and trade balance share respectively, then the coefficient of export share is a+b, and the coefficient for import share is a-b. Whenever this paper refers to coefficients for import and export share it will always be to such reconstructed estimates.

All possible regressions of up to seven variables were run using SAS and the results of the best 25,000 regressions were reported. The best regressions were chosen on the basis of adjusted R-squared, which penalizes overfitting from the introduction of too many independent variables. These regressions ranged in fit from an R-square value of 0.5 to 0.75 – it is important to check this and ensure that the range is sufficiently large enough so as to avoid severe data-mining and focusing only on regressions that may have a spurious good fit. Restricting the subsequent analysis to a

certain number of equations accomplishes the following purposes. Firstly, this is an indirect way of giving more weight to equations which are more likely to be correct, rather than looking at all possible regressions which would include regressions with low fit that are probably grossly misspecified and would adversely influence the estimated coefficients. Also, by giving equal weight to all the coefficients in these top 25,000 regressions, instead of weighting them proportionally according to fit, we are not relatively overweighting equations that may have a spurious very good fit. Also, this allows us to construct another statistic which measures the percentage of the top 25,000 regression models which included a particular variable, called the inclusion rate henceforth. This is a new statistic not included in Sala-i-Martin' s analysis or in other research and is of value for the following reason. It is an important way of further narrowing down the robust variables especially when there are many of them. The notion behind this test statistic is that if a variable is robust but has been included in relatively few of the top 25,000 models then its inclusion is very dependent on the conditioning set used and furthermore its calculated cumulative distribution function is not as reliable as fewer estimates where used to create it. Variables with high inclusion rates however, are more likely to be part of the correct specification as they are more robust to differing conditioning sets at predicting volatility and are less likely to have been included in only a few of the top regression models by chance.

3. A cross-section analysis of all countries

This cross section analysis includes all the countries in the dataset from 1960-1989, assuming that coefficients are the same across all levels of GDP per capita. This assumption is relaxed in the next section where the dataset is broken into high and low income countries for a more detailed analysis. The volatility or standard deviation of growth rates was calculated from the Penn World Table Ver. 6.1 Heston, A., R. Summers and B. Aten (2002) and the average calculated volatility across all countries was 5%.

Table 1 shows the appropriate statistics for the coefficient estimates, assuming normal distributions for the coefficients. This is justified by three normality tests conducted, Kolmogorov-Smirnov, Cramer-von Mises and Anderson-Darling, with all variables passing all three tests at a 5% level of significance.

3.1. **Results from the all possible regressions analysis**

1. Political variables: The civil rights and rule of law indices have the expected signs, since more civil rights[1] and better rule of law leads to lower volatility, although the coefficient of rule of law is not robust[2]. The index of political rights however, has the opposite sign (the variable is also measured backwards) of what would be expected and is quite robust with respect to different model specifications. The negative coefficient for the number of political assassinations is also surprising since it would be reasonable to assume that more assassinations would lead to greater uncertainty and volatility. OECD economies as expected suffer from less volatility than non-OECD economies. The OECD variable is probably acting as a proxy for other underlying variables which have not been included in the analysis, such as the quality of institutions (e.g. central bank independence), level of corruption etc. Strength of democracy, number of years at war, and number of revolutions and coups are as expected positively related to volatility and robust. Political instability has a positive relationship with volatility but the relationship is very fragile.

2. Openness variables: The most robust openness indicator is export share which is positively related to volatility and has a high inclusion rate. The coefficient for import share is also robust but smaller than that of export share. The number of years an economy has been open from 1950-90 is positive but not particularly robust. The free trade openness index is very robust and also positive. The fact that all openness variables have positive coefficients is reassuring when reaching the conclusion that openness in general has a positive influence on volatility.

3. Regional variables: The African and Latin American dummy variables are both positive but not robust which is an indication that the other variables included in this analysis have probably compensated for the particular characteristics of these regions without the need for dummy variables to pick up these effects. The positive relationship between the dummy for oil producing countries and volatility is not surprising given the variability in the price of oil and the strong dependence of these economies on oil revenue.

4. Market distortion variables: Dollar, D. (1992) suggested the real exchange rate distortion index as a measure of the restrictiveness of a country's trade policy by

[1] Note, that the coefficient for civil rights is positive because this index assigns greater values to less public rights.

[2] For ease of exposition, robust henceforth in this paper refers to variables whose cdf lies 95% to one side of zero.

attempting to indirectly measure the extent the real exchange rate of an economy has been driven away from a free trade reference level by the trade regime. This index is positively related to volatility, is the second most robust result and has the highest inclusion rate. The black market premium, BMP, is a measure of the currency controls and financial distortion in the foreign sector and as a sign of economic uncertainty is positively related to the volatility as expected and extremely robust. The standard deviation of the black market premium can also be of great significance because if the black market premium is volatile then not only are the relative prices of goods distorted but there is also uncertainty as to the future distortion so that the efficient allocation of inputs and goods for the economy is also volatile and uncertain. The relationship is as expected positive and very robust but this variable has a low inclusion rate of only 10%.

5. Type of economic organization: The dummy variables for socialist economies and mixed government are robustly related to volatility with socialist economies tending to have higher volatility. It could be inferred from this result that more government intervention in the economy leads to greater volatility. However as only 7 countries in the sample are regarded as socialist according to this index, interpretations should be made with a degree of caution.

6. Economic variables: The second most robust variable was the inflow of direct foreign investment as a ratio of GDP. Unfortunately, the datasets used provided data only on inflows of FDI and not outflows. FDI inflows can influence volatility through two routes. The direct route is due to the direct effect of capital inflows and new productive capabilities on income, especially for smaller developing countries. Indirectly, an inflow of FDI means that it is possible for large future outflows of capital to take place thereby also affecting volatility. It should be noted that this variable may also be acting as a proxy for the openness of an economy and degree of integration with the global economy. The income share of government consumption is extremely robust and positive but should not be interpreted by itself as another related variable, public consumption minus education and defense as a fraction of GDP is robust and negative. Overall, because the mean coefficient for the income share of government consumption is much larger than that of public consumption minus education and defense as a fraction of GDP, all types of government spending are positively related to volatility with education and defense spending seem to be more

important than other types of government spending[3]. Perhaps the most surprisingly result here is that the relationship between price inflation and volatility appears to be negative although not robust. Standard economic theory links high inflation to economic uncertainty as consumers and firms find it more difficult to predict expected inflation, future costs of inputs and goods etc. A possible explanation is that economic agents may adapt to persistent high inflation so that the economic costs and uncertainty are reduced, in which case it is surprise inflation (or the volatility of inflation) that should create uncertainty rather than the level. Also, it must be noted that the relationship between volatility and inflation may be highly non-linear, and therefore not captured by the linear specifications used in this study. This result should be interpreted as implying no significant relationship between reasonable levels of inflation and volatility, and not as extending to the case of hyperinflation. According to Acemoglu, D. and F. Zilibotti (1997), real GDP per capita should be expected to have a robust negative relationship with volatility. They suggest that the link occurs through the fact that poorer countries only have access to risky and low-productivity technologies. In their study they perform a simple regression between volatility and real GDP per capita with no conditioning set[4]. However the coefficient in this study's analysis is positive, with a cdf that is 86% positive, a finding that leads to the conclusion that the results of the simple regressions are due to non-conditioning or specification bias. The positive relationship is present in all the econometric models in this study (see later sections) and begs explanation of which none has been offered in the literature to the best of my knowledge. I hypothesize two possible explanations for this result. Firstly, the positive relationship may reflect a shift in the composition of real GDP per capita as countries become richer, so that investment, which is more volatile than other forms of spending, such as consumer spending, may come to make up a larger percentage of income, leading to greater volatility ceteris paribus. A second possible explanation may rest on the relationship between the degree of risk aversion of economic agents and their income/wealth. Guiso, L. and M. Paiella (2001) and Hartog, J., A. Ferrer-i-Carbonell and N. Jonker (2000) find evidence from field studies that risk aversion decreases with income and wealth.

[3] This effect is probably solely attributed to defence spending rather than education spending as there seems no plausible explanation for education spending affecting volatility any more than other types of government consumption. Indeed, defence spending could be acting as a proxy for uncertainty in an economy due to the threat of war or existence of unfriendly neighbours.

[4] Such a regression on this dataset yields a coefficient of -0.76 for a standard linear regression, and of -0.57 for a robust s-estimation regression.

Hence, investors and entrepreneurs in richer countries will tend to be more willing to take on risky investments, firms will be more willing to leverage themselves, consumers will also be more prone to consuming on credit, all of which will lead to greater volatility in the economy.

7. Financial variables: As expected the standard deviation of domestic credit is a very important predictor of volatility through its effect on the fluctuations of both consumption and investment, and thereby on both the aggregate demand and the aggregate supply of the economy. It also directly creates uncertainty about possible future capital constraints of agents and firms as they can not be sure as to how much funding will be available to them in the future. The ratio of M1 to GDP, is robustly positively related to volatility, as is the ratio of quasi-liquid liabilities to GDP[5], indicating that the greater the share of liquid and quasi-liquid assets in an economy the greater the volatility. The result for the ratio of quasi-liquid liabilities to GDP goes contrary to standard theory because the ratio of quasi-liquid assets has been suggested by King, R. G. and R. Levine (1993) to be a proxy for financial sophistication. Hence, one would expect that the greater the ratio of quasi-liquid assets to income, the lower the volatility as the economy is financially more sophisticated. However, it should be noted that the growth rate of the ratio of quasi-liquid assets to income was negative and robust, thereby complicating any possible conclusions. A possible explanation, is that the growth rate will be large and therefore will lead to less volatility in cases where the financial sector is not already sophisticated whereas in cases of relatively sophisticated financial sectors the growth rate will be low and the positive effect of the level of quasi-liquid liabilities will dominate leading to increased volatility. In moving towards a more sophisticated financial sector firms have better access to funds allowing greater project diversification leading to less volatility, but once the financial sector reaches a high level of sophistication these diversification benefits may be exhausted and from then on the higher quasi-liquid liabilities are relative to GDP the higher the leveraging of the economy leading to greater volatility. This is in line with Easterly, W., R. Islam and J. E. Stiglitz (2000) who find that there is a non-linear relationship between volatility and financial depth so that increased private sector credit to GDP initially leads to less volatility up to a point and then beyond that

[5] Quasi-liquid assets are M3 money supply less M1, consisting of long-term deposits and assets – such as certificates of deposit, commercial paper, and bonds – that can be converted into currency or demand deposits.

point may contribute positively to volatility. Moving on to variables whose results match the financial sophistication argument, the ratio of central bank domestic assets to GDP is positive and robust. Also, the robust and negative coefficients of the ratio of private domestic assets to total domestic assets and its growth rate implies that the greater the share of credit allocated to private enterprises (and the greater the growth rate of this share) the lower the volatility. Another indirect measure of financial sophistication is the growth rate of currency held outside of banks as a share of GDP, whose coefficient is both positive and robust. This variable may be expected to be negative if banking transaction costs are falling over time and/or interest rates are increasing so that people have an incentive to keep less cash on hand and prefer to make many smaller withdrawals from bank accounts. Also, in sophisticated financial systems there may be a shift towards increased use of credit/debit cards so that once again less cash is needed to satisfy the transactions demand for money of individuals. As countries become richer, consumption will tend to form a smaller percentage of income as savings start to rise and therefore transactions demand for money as a share of GDP will be expected to fall. The growth rate may be positive if faith in the banking system is failing, especially in cases of financial crises, where people will prefer to keep money under the mattress than deposit it in a bank. The growth rate in currency held outside banks as a share of GDP is -2.3% for OECD countries and 0.2% for non-OECD countries (with many countries exhibiting positive growth rates).

4. The cross section analysis broken into high and low income datasets

The previous dataset is now broken into two equal subsets, the first one comprising of half of the countries with the highest income per capita and the second of countries with the lowest income per capita. The goal of this exercise is to search for any significant differences between the independent variables that affect volatility in countries with different income levels.

4.1. Results from variable comparisons across low and high income groups

1. Openness variables: The variable, number of years an economy has been open, although positive and very robust in the high income set becomes extremely fragile in the low income set. In contrast, the positive value of the coefficient of the free trade openness index is much larger in the low income set, of the order of ten. In the high

income subset, reconstructed coefficients for export and import share are negative and positive respectively, although non-robust. In the low income set, both variables are not robust and the signs of the coefficients are reversed. Also, the magnitude of the coefficients is much smaller in the low income dataset. Hence, exports and imports seem to be important predictors in explaining cross-country differences in volatility across all levels of real GDP per capita but not within subgroups.

2. Economic variables: Direct foreign investment inflows seem to be robust and positive only in the high income set, with virtually no effect on low income countries. The income share of government consumption is not robust at all in high income countries but robustly positively related to volatility in low income countries. If we assume that government is less competent and perhaps more corrupt in developing countries, then this may be the reason why greater government involvement increases volatility only in these countries. Real GDP per capita in both cases is positive, but the average coefficient is much larger in the low income data set. This further supports the unexpected positive relationship found throughout this study.

3. Financial variables: An interesting result is that for both datasets the coefficient of the ratio of deposit banks' domestic assets to total domestic assets is positive, albeit with cdf over 90% but less than 95% to the right of zero. Thus it seems that a possible argument that commercial banks have better incentives to allocate credit efficiently to creditworthy firms than the central bank and therefore should do a better job at allocating credit is wrong. The ratio of M1 to income is more robust and important in low income countries, with a larger ratio leading to lower volatility. Also, in the high income group, the higher the ratio of private domestic assets to total domestic assets and the higher the ratio of gross claims on the private sector by the central bank, the higher the volatility implying that increased leveraging of firms in an economy leads to greater volatility. This is a reasonable result since standard corporate finance theory enunciates the same principle. Increasing the debt load of a firm, ceteris paribus, leads to an increase in the rate of return but also to an increase in the volatility of return. A surprising result is that the ratio of quasi-liquid liabilities to GDP and its growth rate, which proxy for the size of the financial sector, are not robust at all in any of the two datasets, in contrast to the previous analysis of the whole set of data. The general results for the financial variables are in contrast with most studies that find that increased financial market sophistication, as measured using the above proxies, tend to reduce volatility (both of these studies have however used fairly restrictive

conditioning sets). An exception is the ratio of central bank assets to GDP which is robust and positive but only in the low income country dataset. This may be due to the fact that for countries with fixed or pegged exchange rates, more central bank assets reassure investors that the central bank can support this regime in the future leading to less uncertainty.

4. Market distortion variables: The black market premium and its standard deviation are both robust in both high and low income countries, with the standard deviation playing a much more important role in the low income countries than in the high income countries. In low income countries, the real exchange rate distortion is positive with a cdf of 1 to the right of zero and an impressive inclusion rate of 97.

5. A cross section analysis from 1974-89 including external debt, government deficit, and tax revenue variables

The previous analysis did not include variables for government deficits or any debt variables as these were not widely available from 1960. The following table contains data regarding an all possible regressions analysis for this time period which includes the following variables of special interest: government deficit as a percentage of GDP, long term and short term debt as percentages of GDP, and the ratio of short term debt to total debt. The debt data is taken from Global Development Finance database. The data is for 51 countries as the debt statistics were not available for the other countries in the original dataset. Although countries were included on the basis of availability of debt statistics, because debt data was mostly available for developing countries with low GDP per capita, this dataset should be regarded as such.

The coefficient for deficits is extremely robust and positive indicating that large deficits tend to decrease volatility, perhaps because governments use deficits to try to stabilize the economy and succeed in doing so. The effect however is not very significant from an economic viewpoint since a 1% point increase in the deficit decreases volatility by only approximately 0.1% points.

The coefficient on long term debt is also very robust and is negative, indicating that a higher total debt ratio leads to lower volatility. This is contrary to what one might expect since countries with high debt ratios could create uncertainty as to debt repayment capabilities. However, the result is not particularly economically significant since an increase in debt by 10% points decreases volatility only by

0.137% points. The coefficient on short term debt is also negative but not very robust or economically significant. Also, the term composition variable of debt appears not be related to volatility. Other interesting results include a positive coefficient for real GDP per capita, further supporting the contrast discussed in the previous section as in this case the coefficient is also extremely robust. Government spending variables are again robust and economically significant, just as in the original low income dataset analysis. Real exchange rate distortion and black market exchange rate premium are both not robust, a striking result given their significance in the previous analyses, which may be attributed to the smaller selection of countries and time periods included in this sample.

The average reconstructed export coefficient is 0.244 with a standard deviation of 2.49, yielding a cdf that is only 0.54 positive. For import share, it is -2.21 and 1.18 yielding a cdf of 0.97. These results are also very close to those of the 1960-89 low-income dataset analysis.

This dataset also includes some variables that were not in the previous analysis. Variables that are robust and positively related to volatility include the ratio of central government corporate income tax revenue to GDP, the ratio of social security taxes to GDP, the ratio of central government defense expenditure to GDP and the ratio of import taxes to imports. As such government intervention in a variety of forms seems to contribute to an economy's volatility.

6. Single equation models of volatility

The previous procedure used was useful in checking the robustness of variables affecting volatility, but does not lead to a single equation that could be used to predict volatility. Proceeding to model the relationship between volatility and other variables in single equations, Table 4 shows the results from 3 different models. The independent variables were chosen according to the following rule – variables to be included must have a cdf of at least 0.95 to one side of zero must have an inclusion rate of at least 20%, as established in the previous section.

Robust estimation was performed using a high breakdown value method called S-estimation, introduced by Rousseeuw and Yohai (1984). The finite sample version of the breakdown point, according to Donoho, D. L. and P. J. Huber (1983) is the smallest fraction of contamination, as a percentage of the sample size, that could cause an estimator to be infinitely biased. Let D be any sample of n data points

(including the dependent and independent variables), R be a regression estimator, and D' be a sample corrupted by m outliers. The breakdown point of an estimator R is defined as

$$\min\left\{\frac{m}{n};\ \sup_{D'}\left\|R(D')-R(D)\right\|=\infty\right\} \tag{1}$$

In OLS, a single outlier is enough to cause the estimator to take on values arbitrarily far away from the uncorrupted sample i.e. by making a single outlier infinitely positive or negative the bias of the estimator will also approach infinity. Hence the breakdown point of OLS equals the inverse of the sample size, a value which tends to zero as the sample size increases. Instead of minimizing the sum of squared residuals, S-estimation minimizes the dispersion of the residuals, s, where the dispersion is a solution to

$$\frac{1}{n}\sum_{i=1}^{n}\rho\left(\frac{\varepsilon_i}{s}\right)=\text{constant} \tag{2}$$

where ρ is symmetric, continuously differentiable, ρ(0)=0 and there exists c>0 such that its derivative is positive on [0,c] and constant on [c,∞]. It is this constant segment of ρ that creates the robustness of this estimator as the function ρ of all residuals (standardized with respect to scale, s) higher than c are effectively truncated to the value of ρ(c)[6].

S-estimators have some very desirable properties such as achieving the maximum possible breakdown point (50%), being robust to outliers both in the y-direction and the x-direction (leverage points), and have higher efficiency, for a given breakdown value, than other robust estimators such as LTS-estimators. A robust regression technique was chosen to model the equations due to the problems of leverage points and outliers that are present in macroeconomic data, with this dataset being no exception.

The first model is a regression using the whole data set, model two uses the forty-nine countries of the original dataset with the highest real gdp per capita, model three is composed of countries with the lowest real gdp per capita. All three regression models fit the data well as the R-square ranges from 0.6744 to 0.8433. Volatility appears to be more predictable in the case of the high income per capita group compared to the low income capita group. This is reasonable as the low income

[6] For more technical details on S-estimation see ROUSSEEUW, P. J., and A. M. LEROY (1987): *Robust Regression and Outlier Detection*. John Wiley & Sons.

group may be more susceptible to other psychological and social variables that are not included in the models that may affect expectations of local residents, and more importantly market expectations of foreign investors e.g. leading to herding behavior in the economy which would increase volatility.

Standardized coefficients are also presented as a measure of the economic significance of the independent variables. In model one, the most economically significant variable determining volatility is FDI inflows, followed by civil liberties, real exchange rate distortion and standard deviation of domestic credit.

It is interesting to note that government share of income in the full dataset is not statistically significant at the 5% level, although in the all possible regressions analysis it was extremely robust and had an inclusion rate of 42%. This may be due to the fact that in the all possible regressions analysis, normal regression methods were used, in contrast to the robust regression used in the single equation estimation. Hence, it is quite likely that this result was influenced by leverage points and outliers in the dataset, and that government share is not a statistically significant determinant of volatility across all countries. However in the low income group, government share of income is significant at the 1% level and the coefficient is economically significant. The positive relationship between government share and volatility may have something to do with government corruption, destabilizing government intervention, foreign investor expectations of greater risk etc, which should be more relevant for poorer countries rather than richer countries. We cannot however rule out that this result may be due to the fact that government consumption share may be proxying in the low income countries for other variables not included in the analysis.

7. **Panel data estimation**

In their study King and Levine also used a panel data set for the period of 1960-1989 utilizing 5 year averages. Regrettably fewer variables are available in this format, and a majority of the variables were dropped from the subsequent analysis due to severe problems of missing observations. Despite this, it is still of interest to perform a panel data analysis as it will clarify whether previous results hold not only across countries but also within countries across time. Also, it will include country specific and time effects which are ignored in cross-section analysis, and will not be as susceptible to endogeneity problems as volatility averages are computed across five years and independent variables are the values at the beginning of each five year

period. The econometric technique used is a least squares method with panel corrected standard errors as proposed by Beck, N. and J. Katz (1995) which allows for heteroskedasticity and possible contemporaneous correlation of the error terms across cross-sections.

Two models are estimated, one with fixed effects for each country and for each time period, Table 5, and one with only a single constant, Table 6. The inclusion of the fixed effects was strongly supported by a LR test, with the test statistic equal to 230.15 which is statistically significant at the 0.1% level. The inclusion of fixed effects however, renders all independent variables statistically insignificant at the 5% level except for the average inflation of the GDP deflator. In contrast, in the model without fixed effects, trade share of GDP, real GDP per capita, government consumption share of GDP and the ratio of quasi-liquid liabilities to GDP are all statistically significant at the 5% level. This sharp contrast points to the problem of the reduced number of independent variables in this analysis which leads to the fixed effects proxying for any missing independent variables and rendering most of the used independent variables as statistically insignificant. The problems caused by using such a reduced dataset are further supported by the fact that in the model without the fixed effects, real GDP per capita now has a significant negative effect on volatility as is found in all other studies with small conditioning sets. This is really only due to the fact that real GDP per capita in this case is forced to proxy other effects correlated with it such as political and variables, civil and legal variables etc. Therefore, the results form the panel regression without fixed effects should be treated with some skepticism.

In the estimated model without fixed effects, the reconstructed coefficients for export share is 2.097 (standardized coefficient=0.183) and is statistically significant at the 0.76% level. Import share is found not to be statistically significant (p-value=0.099). Government consumption share is found as in the other analyses to be statistically significant and positively related to volatility. The ratio of quasi-liquid liabilities to GDP is also highly statistically significant and negatively related to volatility, in fact it has the largest in magnitude standardized coefficient. This however is in contrast to the all possible regressions analysis where it was found to be robustly positively related to volatility.

The inclusion of fixed effects to the model changes the results considerably. Coefficients of real GDP per capita and the ratio of quasi-liquid liabilities to GDP are

now both positive (although not statistically significant) instead of negative as in the model without fixed effects. The signs of these coefficients are now in accord with those estimated from the all possible regressions analysis. Government consumption share of GDP is still positive and has a large standardized coefficient but is significantly different from zero only at the 16% level. The only statistically significant variable is average inflation of the GDP deflator which however is not economically very significant, at least for cases of reasonable inflation levels, as the standardized coefficient is only 0.078 and an increase in 10% points in inflation leads only to an increase of 0.1% points in volatility. Both reconstructed coefficients for export and import share are found not be statistically significant at the 5% level with p-values of 0.104 and 0.27 respectively. The estimated time period fixed effects can be thought of as common shocks to all the economies in this analysis and it verifies the decreasing nature of these shocks over time as they start off at 1.4 for 1960-1964 and steadily decrease to -1.3 in 1985-1989.

8. Conclusions

This paper has exhaustively analyzed the determinants of volatility in growth rates using all possible regressions analysis in order to avoid the ambiguity inherent in econometric studies using different conditioning sets. Included variables came not only from the financial sector, as has been the key focus of the limited literature so far, but included general macroeconomic and political variables. Both cross-section and panel data were utilized as a means of backing up and verifying results from each study.

The main results of this paper are the following. Real GDP per capita, contrary to other studies and common beliefs, is positively related to volatility, a result that is supported by both cross-section and panel data estimation. Possible explanations for this result include the empirical result that risk aversion tends to fall with wealth, and the fact that as countries become richer there is a shift in the composition of national income so that investment, which is the most volatile component of national income, makes up for a greater share of GDP. The influence of financial sophistication upon volatility is not as clear cut as would seem as in many cases proxies for financial sophistication, such as the ratio of deposit banks domestic assets to deposit banks and central bank assets, are positively related to volatility. Openness variables with few exceptions are positively related to volatility, export share is more important than

import share, and there does not seem to be any significant relationship between inflation and volatility.

The main policy implications of this research derive from the general observation that most types of government intervention in the economy adversely affect growth rate volatility. The robust results regarding the positive relationships between volatility, the real exchange rate distortion, black market exchange rate premium, and ratio of import taxes to imports imply that authorities should move to abolish currency controls and seek to abolish restrictive trade policies that distort the real exchange rate from its free trade level if they wish to diminish volatility. Also, government consumption as a share of GDP on volatility should be reduced as results across the board indicate an adverse effect upon volatility.

Performing a panel data analysis without fixed effects on a much reduced dataset highlighted the problems associated with studies with small conditioning sets as the signs of some variables where different from those estimated from panel data regressions with fixed effects to soak up the effects of other missing variables and from those estimated in the all possible regressions analysis. The gain in utilizing time series information with panel data compared to only cross-sectional data is outweighed by the problems of lack of panel data for many variables and countries.

It is hoped that this study will prompt more empirical and theoretical research in this important field that has been largely neglected so far. In particular, the next step for research is to focus on establishing causality between the variables studied here instead of just correlations.

Table 1 – Statistics for the top 25,000 regressions

Variable	Mean	Std	Cdf	Inclusion rate
Real Exchange Rate Distortion	0.022272	0.002459	1	98.91
Direct Foreign Investment Inflows	4.290733	0.381847	1	45.22
Black Market Exchange Rate Premium	0.689779	0.085131	1	15.53
Growth rate of ratio of private domestic assets to total domestic assets	-14.8806	2.155297	1	16.50
Outward Orientation	-0.75028	0.114142	1	17.65
Government Consumption Share of Gross Domestic Product	10.90774	2.181239	1	42.07
Standard Deviation of Black Market Premium	0.003212	0.000669	0.999999	9.94
Growth rate of inflation	0.014019	0.00336	0.999985	11.15
Export Share of GDP	2.288439	0.593485	0.999942	76.94
Ratio of central bank domestic assets to GDP	3.828156	1.006997	0.999928	10.12
Index of Civil Liberties	0.915797	0.246134	0.999901	99.06
Dummy variable for OPEC	1.052373	0.28457	0.999891	8.97
Dummy variable for mixed government	-0.8634	0.234735	0.999883	23.76
Dummy variable for countries that have been involved in war	0.501055	0.138517	0.999851	7.40
Standard deviation of the growth rate of domestic credit	0.006888	0.001991	0.99973	26.01
Index of democracy	1.378411	0.424021	0.999425	9.36
Number of revolution and coups per year	1.018982	0.319115	0.999296	7.77
Growth rate of currency held outside of banks, as a share of GDP	9.88361	3.41372	0.998106	6.76
No. of political assassinations	-0.47743	0.177951	0.996351	8.01
Ratio of M1 to GDP	2.265331	0.924491	0.992864	6.89
Free trade openness index	5.782008	2.393174	0.992155	12.67
Import share of GDP	1.944676	0.807303	0.991999	76.94
Ratio of quasi-liquid liabilities to GDP	1.62622	0.679787	0.991627	7.04
Growth rate of quasi-liquid liabilities to GDP	-2.76757	1.215171	0.988622	5.96
Dummy variable for socialist economies	0.568577	0.261124	0.985275	6.40
Ratio of private domestic assets to total domestic assets	-1.09997	0.521234	0.982585	6.06
Dummy variable for OECD	-1.0331	0.505608	0.979488	11.29
Share of Real Government Consumption Expenditures minus Defense and Education Expenditures	-4.24815	2.361203	0.964002	7.06

Variable	Mean	Std	Cdf	Inclusion rate
Political rights index	-0.55814	0.345518	0.946884	15.28
Ratio of gross claims on the private sector by central bank	0.753766	0.556582	0.912176	5.09
Growth rate of ratio of deposit banks domestic assets to deposit banks and central bank assets	-7.22628	5.487701	0.906049	5.42
Growth rate of terms of trade	15.28906	12.45051	0.890274	4.80
No. of years an economy has been open	0.382906	0.324591	0.880932	5.15
Dummy variable for African countries	0.30791	0.270113	0.872843	5.06
Real GDP per capita in 1960	0.09768	0.088971	0.863873	5.22
Average inflation of GDP deflator	-0.00202	0.002268	0.813088	5.38
Rule of law index	-0.38722	0.448903	0.805818	5.09
Political instability index	0.439653	0.590194	0.771843	4.41
Dummy variable for Latin America	0.121412	0.25165	0.685262	4.84
Growth rate of domestic credit	0.003431	0.01392	0.59734	7.26

Table 2 - Statistics for two subsets of data, high and low income per capita

Countries with highest income per capita				Variable	Countries with lowest income per capita			
Mean	Std Dev	Inc. rate	Cdf		Mean	Std Dev	Inc. rate	cdf
-1.688	1.419	7.46	0.883	Dummy variable for African countries	2.563	0.494	94.028	1
-0.629	0.213	17.66	0.998	No. of political assassinations	0.494	0.626	6.74	0.592
0.803	0.134	33.624	1	Black Market Exchange Rate Premium	0.626	0.397	11.792	0.977
0.008	0.002	26.964	1	Standard Deviation of Black Market Premium	0.397	0.001	7.924	0.958
1.249	0.96	5.412	0.904	Ratio of deposit banks domestic assets to deposit banks and central bank assets	0.001	1.967	9.54	0.927
-2.7	3.633	7.18	0.771	Ratio of central bank domestic assets to GDP	1.967	1.478	8.544	0.999
0.261	0.172	12.18	0.935	Index of Civil Liberties	1.478	0.542	19.892	0.904
1.872	0.637	8.616	0.998	Ratio of private domestic assets to total domestic assets	0.542	1.684	6.692	0.502
1.046	0.662	6.68	0.943	Ratio of gross claims on the private sector by central bank	1.684	1.603	6.44	0.739
1.018	0.652	6.924	0.941	Index of democracy	1.603	0.884	8.98	0.948
14.09	2.509	99.056	1	Direct Foreign Investment Inflows	0.884	0.578	6.172	0.604
1.337	1.291	4.796	0.85	Free trade openness index	0.578	3.968	23.596	1
-21.125	17.073	8.86	0.892	Growth rate of ratio of deposit banks domestic assets to deposit banks and central bank assets	3.968	5.996	14.756	1
18.663	7.604	16.872	0.993	Growth rate of currency held outside of banks, as a share of GDP	5.996	5.597	6.22	0.571
-0.001	0.01	5.1	0.547	Growth rate of domestic credit	5.597	0.008	10.048	0.981
-44.068	9.314	57.388	1	Growth rate of ratio of private domestic assets to total domestic assets	0.008	5.919	6.448	0.768
-0.297	2.176	4.144	0.554	Government Consumption Share of Gross Domestic Product	5.919	2.913	96.004	1
0.009	0.005	10.68	0.97	Growth rate of inflation	2.913	0.094	13.012	1
0.586	2.58	4.216	0.59	Growth rate of quasi-liquid liabilities to GDP	0.094	2.615	6.508	0.527

Countries with highest income per capita				Variable	Countries with lowest income per capita			
-8.015	21.034	4.764	0.648	Growth rate of terms of trade	2.615	17.295	10.652	1
1.242	3.24	4.952	0.649	Share of Real Government Consumption Expenditures minus Defense and Education Expenditures	17.295	1.732	31.72	1
-1.057	0.817	9.288	0.902	Dummy variable for Latin America	1.732	0.756	8.352	0.846
-0.721	1.521	4.896	0.682	Ratio of M1 to GDP	0.756	2.391	8.188	0.969
2.162	1.718	21.708	0.896	Import share of GDP	2.391	1.059	13.212	0.616
-0.194	0.247	5.02	0.784	Dummy variable for mixed government	1.059	0.321	6.852	0.739
-1.469	0.474	47.636	0.999	Dummy variable for OECD	0.321			
-0.767	0.607	6.272	0.897	Dummy variable for OPEC	1.629	0.524	12.812	0.999
0.005	0.004	11.072	0.913	Average inflation of GDP deflator	0.524	0.003	7.58	0.611
5.739	1.144	24.576	1	Political instability index	0.003	1.421	6.636	0.545
0.34	0.13	19.284	0.996	Political rights index	1.421	0.631	10.44	0.732
-0.003	0.927	4.536	0.501	Ratio of quasi-liquid liabilities to GDP	0.631	2.656	7.02	0.643
-0.003	0.006	4.472	0.675	Real Exchange Rate Distortion	2.656	0.004	97.08	1
1.552	0.992	9.968	0.941	Number of revolution and coups per year	0.004	0.647	11.844	0.984
0.022	0.077	4.388	0.61	Real GDP per capita in 1960	0.647	0.468	6.224	0.769
-1.856	0.853	19.428	0.985	Rule of law index	0.468	0.675	9.048	0.985
-0.613	0.183	11.948	1	Outward Orientation	0.675	0.179	15.284	1
4.62	0.819	97.512	1	Dummy variable for socialist economies	0.179	0.255	6.98	0.972
0.005	0.004	6.672	0.882	Standard deviation of the growth rate of domestic credit	0.255	0.001	13.544	1
0.338	0.315	6.288	0.858	Dummy variable for countries that have been involved in war	0.001	0.26	38.72	1
1.504	0.38	21.176	1	No. of years an economy has been open	0.122	0.531	6.072	0.591
-1.538	2.203	21.708	0.757	Export Share of GDP	0.531	1.078	13.212	0.54

Table 3 – Statistics for the top 25,000 regressions for 1974-89 with debt and deficit variables

Variable	Mean	Std	Cdf	Inclusion rate
Dummy variable for mixed government	-1.840	0.276	1.000	8.912
Index of Civil Liberties	0.948	0.185	1.000	13.028
Number of revolution and coups per year	3.063	0.670	1.000	9.348
Real GDP per capita in 1960	0.906	0.239	1.000	69.332
Dummy variable for OPEC	2.147	0.609	1.000	44.524
Government Consumption Share of Gross Domestic Product	37.221	10.859	1.000	11.808
Government Consumption Share of Gross Domestic Product minus Defense and Education Expenditures	44.690	14.955	0.999	17.464
Standard deviation of the growth rate of domestic credit	0.026	0.009	0.998	14.044
Ratio Central Government Corporate Income Tax Revenue to GDP	17.160	6.495	0.996	9.928
Outward Orientation	-0.860	0.326	0.996	8.564
Long term debt	-0.014	0.005	0.995	12.904
Ratio of Central Government Deficit to GDP	10.784	4.287	0.994	10.116
Dummy variable for socialist economies	-1.160	0.471	0.993	21.232
Ratio of Social Security taxes to GDP	22.360	10.005	0.987	23.580
Ratio of central government export tax revenue to exports	-5.805	2.719	0.984	11.880
Dummy variable for OECD	0.998	0.529	0.971	19.136
Import share of GDP	-2.210	1.180	0.970	26.430
Ratio of Central Government Defense Expenditure to GDP	38.104	22.438	0.955	26.736
Ratio of import taxes to imports	4.724	2.895	0.949	10.472
Dummy variable for African countries	1.317	0.843	0.941	11.572
Ratio of central government tax revenue to GDP	-12.730	8.509	0.933	26.756
Real Exchange Rate Distortion	0.006	0.005	0.859	35.160
Average inflation of GDP deflator7489	0.004	0.005	0.800	15.248
Short term debt	-0.022	0.026	0.795	9.284
Share of central government individual income tax to GDP	-6.953	10.850	0.739	10.164
Dummy variable for Latin America	0.464	0.730	0.737	11.560

Variable	Mean	Std	Cdf	Inclusion rate
Black Market Exchange Rate Premium	-0.002	0.005	0.651	18.288
Growth rate of inflation	0.001	0.010	0.558	9.920
Ratio of short term debt to total debt	-0.004	0.029	0.553	10.884
Export share of GDP	0.244	2.493	0.539	26.430
Central Government Gross Capital Formation	1.365	15.545	0.535	12.392

Table 4 – S-estimation robust regression models

Model no.	**Model 1 (Robust r-square=0.6744)**			**Model 2 (Robust r-square=0.8433)**			**Model 3 (Robust r-square=0.7288)**		
Dataset	**All**			**High RGDP**			**Low RGDP**		
Variables	**Raw coeff.**	**Standardized coeff.**	**Chi-square significance**	**Raw coeff.**	**Standardized coeff.**	**Chi-square significance**	**Raw coeff.**	**Standardized coeff.**	**Chi-square significance**
Intercept	-2.3904		0.0108	2.5168		<.0001	-2.7565		0.1003
Real Exchange Rate Distortion	0.0225	0.3129	<.0001				0.0231	0.361	0.0002
Direct foreign investment inflows	12.1408	0.4665	<.0001	12.1829	0.3595	<.0001			
Trade share of GDP	1.1836	0.1273	0.0431						
Government consumption share of GDP	4.843	0.0795	0.2099				14.9536	0.2498	0.0041
Index of civil liberties	0.6432	0.4173	<.0001						
Dummy variable for mixed government	-0.62	0.1066	0.081						
Standard deviation of the growth rate of domestic credit	0.0087	0.2026	0.0006						
Black market exchange rate premium				0.6601	0.1524	0.0102			
Standard deviation of black market premium				0.0041	0.0974	0.1477			
Growth rate of ratio of private domestic assets to total domestic assets				-32.9881	-0.2074	0.0041			
Dummy variable for OECD				-1.1465	-0.2312	0.0062			
Political instability index				4.9925	0.1464	0.0125			

Variables	**Raw coeff.**	**Standardized coeff.**	**Chi-square significance**	**Raw coeff.**	**Standardized coeff.**	**Chi-square significance**	**Raw coeff.**	**Standardized coeff.**	**Chi-square significance**
Dummy variable for socialist economies				4.1084	0.4546	<.0001			
No. of years an economy has been open				0.8508	0.1136	0.1395			
Dummy variable for African countries							2.4874	0.4141	<.0001
Free trade openness index							8.8346	0.1212	0.1564
Share of real government consumption expenditures minus defense and education expenditures							-4.526	-0.0724	0.4008
Dummy variable for countries that have been involved in war							1.3846	0.2365	0.0075

Table 5 – Panel data estimation with fixed effects

Variable	Coefficient	Std. Error	t-Statistic	p-value	Standardized coefficients
Constant	-0.437629	1.786419	-0.244975	0.8066	
Trade share of GDP	2.554841	1.820628	1.403274	0.1615	0.223464226
Trade balance share of GDP	0.584271	0.373551	1.5641	0.1188	0.062760406
Real GDP per capita	0.005122	0.168807	0.030345	0.9758	0.003322816
Government Consumption Share of Gross Domestic Product	14.09771	10.03753	1.4045	0.1612	0.194160078
Average inflation of GDP deflator	0.010162	0.003145	3.23131	0.0014	0.077698332
Ratio of deposit banks domestic assets to deposit banks and central bank assets	1.155649	1.446262	0.799059	0.4249	0.068987087
Ratio of quasi-liquid liabilities to GDP	1.560905	1.948554	0.801058	0.4237	0.097418184

R-squared=0.516 Log Likelihood=-954.5683

Fixed Effects							
DZA	3.06	SLV	-0.28	KOR	0.00	PRT	-1.58
ARG	-0.07	ETH	1.57	LSO	-4.32	RWA	1.91
AUS	-2.38	FJI	0.68	MDG	0.32	SEN	2.01
AUT	-3.55	FIN	-2.59	MWI	1.63	ZAF	-3.22
BGD	1.90	FRA	-3.61	MYS	-3.75	ESP	-1.99
BRB	-0.40	GAB	4.71	MLI	3.20	LKA	-1.49
BEL	-4.16	GMB	-2.54	MRT	1.90	CHE	-2.97
BRA	0.04	GHA	6.24	MUS	-0.29	SYR	9.24
BDI	6.53	GRC	-0.04	MEX	1.18	TZA	5.70
CMR	5.32	GTM	-0.25	MAR	0.54	THA	-0.85
CAN	-3.27	HND	-0.31	NLD	-5.07	TGO	4.18
CAF	0.21	ISL	-1.65	NZL	-1.16	TTO	-0.25
TCD	7.50	IND	0.69	NIC	2.66	TUR	0.76
CHL	3.96	IDN	-0.63	NER	3.95	UGA	2.18
COL	-0.93	IRN	5.19	NGA	6.51	USA	-2.91
COG	5.73	IRL	-3.50	NOR	-4.02	URY	0.36
CRI	-1.48	ISR	-6.20	PAK	0.53	VEN	-0.70
CIV	-0.10	JAM	-0.77	PAN	-1.09	ZAR	0.39
CYP	1.62	JPN	-1.93	PNG	-2.67	ZMB	-1.27
DOM	0.66	JOR	-0.30	PER	1.37	ZWE	0.38
EGY	0.16	KEN	1.54	PHL	0.01	GUY	0.75
						BEN	0.84

Fixed Effects (Period)	
1960-1964	1.409056
1965-1969	0.020265
1970-1974	0.24533
1975-1979	0.103573
1980-1984	-0.469124
1985-1989	-1.3091

Table 6 – Panel data estimation without fixed effects

Variable	Coefficient	Std. Error	t-Statistic	p-value	Standardized coefficients
Constant	3.307258	0.697062	4.744567	0	
Trade share of GDP	1.601252	0.642706	2.491421	0.0131	0.140056676
Trade balance share of GDP	0.495333	0.340396	1.455165	0.1464	0.053206989
Real GDP per capita	-0.299408	0.07379	-4.057577	0.0001	-0.194236203
Government Consumption Share of Gross Domestic Product	10.7074	4.606991	2.324164	0.0206	0.147467186
Average inflation of GDP deflator	0.004603	0.002517	1.829008	0.0682	0.035194393
Ratio of deposit banks domestic assets to deposit banks and central bank assets	0.225245	0.936694	0.240468	0.8101	0.013446121
Ratio of quasi-liquid liabilities to GDP	-3.868659	1.202127	-3.218177	0.0014	-0.241448221

R-squared=	Log Likelihood=
0.144575	-1069.644

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